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Deposition dynamics of multi-solvent bioinks PAUL KANEELIL, MIN PACK, CHUNXIAO CUI, LI-HSIN HAN, YING SUN, Drexel University — Inkjet printing cellular scaffolds using bioinks is gaining popularity due to the advancement of printing technology as well as the growing demands of regenerative medicine. Numerous studies have been conducted on printing scaffolds of biomimetic structures that support the cell production of human tissues. However, the underlying physics of the deposition dynamics of bioinks remains elusive. Of particular interest is the unclear deposition dynamics of multi-solvent bioinks, which is often used to tune the micro-architecture formation. Here we systematically studied the effects of jetting frequency, solvent properties, substrate wettability, and temperature on the three-dimensional deposition patterns of bioinks made of Methacrylated Gelatin and Carboxylated Gelatin. The microflows inside the inkjet-printed picolitre drops were visualized using fluorescence tracer particles to decipher the complex processes of multi-solvent evaporation and solute self-assembly. The evolution of droplet shape was observed using interferometry. With the integrated techniques, the interplay of solvent evaporation, biopolymer deposition, and multi-drop interactions were directly observed for various ink and substrate properties, and printing conditions. Such knowledge enables the design and fabrication of a variety of tissue engineering scaffolds for potential use in regenerative medicine.

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